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ABSTRACT

Common in briefing presentations and in individualized instruction is the use of slides that present materials prepared on a typewriter (questions, instructions, outlines). To increase the efficiency and effectiveness of producing these kind of slides a procedure was developed to facilitate: (1) formatting copy to be used for slides; (2) using ortho, diazo, and high contrast materials; (3) making double exposures; (4) producing positive slides; and (5) captioning photos for use in instructional sequences. (EMH)

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# TECHNIQUES FOR GENERATING INSTRUCTIONAL SLIDES

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November 1975
Final Report for Period May 1974 – July 1975

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Technical Training Division

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The visuals used in carrels in learning centers are normally produced in one of three ways. They may be photographs of objects or procedures. They may be drawings rendered by a graphics specialist. The third type, and the one of particular relevance in this report, are the images that can be prepared on a typewriter. These would be questions, verbal instructions, outlines, key points, or any other content that can be prepared by typing. While this type of slide is common in briefings, the large volume of them required in individualized instruction warrants spending considerable time and effort in developing an efficient and effective method of producing them rapidly yet with acceptable quality.



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Within this context, this report describes some techniques that might facilitate the production of instructional slides for use in training programs. The information is organized into initial sections describing formatting and the preparation of copy for slides followed by sections describing how this copy is used in the preparation of slides utilizing (a) ortho or high contrast film, (b) diazo type materials, (c) double exposures, and (d) positive slides. The final chapter describes the captioning of photo . as a technique for producing instructional sequences.

## SUMMARY

### Problem

The current emphasis on self-paced individualized instruction within the Air Force is often accompanied by a massive increase in the number of slides required. Whether used in prenarrated slide sequences or other forms of mediated instruction, slides are being required in numbers that far exceed the production capabilities of many bases.

### Approach

The visuals used in carrels in learning centers are normally produced in one of three ways. They may be photographs of objects or procedures. They may be drawings rendered by a graphics specialist. The third type, and the one of particular relevance in this report, are the images that can be prepared on a typewriter. These would be questions, verbal instructions, outlines, key points, or any other content that can be prepared by typing. While this type of slide is common in briefings, the large volume of them required in individualized instruction warrants spending considerable time and effort in developing an efficient and effective method of producing them rapidly yet with acceptable quality.

### Results

Within this context, this report describes some techniques that might facilitate the production of instructional slides for use in training programs. The information is organized into initial sections describing formatting and the preparation of copy for slides followed by sections describing how this copy is used in the preparation of slides utilizing (a) ortho or high contrast film, (b) diazo type materials, (c) double exposures, and (d) positive slides. The final chapter describes the captioning of photos as a technique for producing instructional sequences.

A consistent effort was made to avoid placing excessive demands on graphic specialists by utilizing the skills of typists in producing narrative images, and to utilize photographic techniques in illustrating objects and procedures.

### Conclusions

It is urged that production techniques be developed that utilize all three specialists (typists, graphic, and photographic) rather than concentrating on a single type of image. This will result not only in variety in the training program, but will also foster economy and increased efficiency.

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# TECHNIQUES FOR GENERATING INSTRUCTIONAL SLIDES

## I. INTRODUCTION

The current emphasis on self-paced individualized instruction within the Air Force is often accompanied by a massive increase in the number of slides required. Whether used in prenarrated slide sequences or other forms of mediated instruction, slides are being required in numbers that far exceed the production capabilities of many bases. This report is an attempt to suggest production procedures and techniques that might facilitate the meeting of these requirements without excessive expenditure of money and/or manpower.

Instructional slides can usually be classified into three types: (1) textual, (2) graphic, and (3) photos. Textual slides present words, phrases, and sentences. Graphics slides present graphs, tables, charts, schematics, diagrams, line drawings, cartoons, and illustrations. Photos include all the slides and pictures made originally with a camera. Without attempting to make mutually exclusive verbal definitions, the three classifications are used here to define primarily the skills of the persons generating the original material. The text slides may be created by a typist or a person using lettering devices. Graphic material usually involves the talents of a graphics technician or illustrator. Photos are created by photographers and photo lab technicians.

The initial discussions in this report are directed at the generation of text and simple graphic slides. Captioned photos are covered in the final section. It is urged that production techniques be developed that utilize all three types of images, rather than concentrating on a single type. This will result not only in variety but also in economy and effectiveness. The ultimate criterion is that the final instructional package will be cost effective in meeting defined training objectives.

This report assumes that the slides are being developed in accordance with established instructional system development procedures including the establishment of training objectives and the specification of the task to be performed, the level of performance and the conditions under which the task will be performed.

Within this context, the intent is to describe some techniques that might facilitate the production of instructional slides for use in training programs. To accomplish this, the information is organized into initial sections describing formating and the preparation of copy for text slides, followed by sections describing how this copy would be used in the preparation of slides utilizing (a) ortho or high contrast film, (b) diazo type materials, (c) double exposures, and (d) positive slides. This final section describes the captioning of photos as a technique for producing instructional sequences.

A consistent effort was made to avoid placing excessive demands on graphic specialists by utilizing the skills of typists in producing narrative images, and by utilizing photographic techniques in illustrating procedures and objects. It is urged that production techniques be developed that utilize all three types of specialists rather than concentrating on a single type of image. This will result not only in variety in the training program but will also foster economy and increased efficiency.

## II. FORMAT

There are no hard and fast rules governing the format of a slide. There are some general rules, however, that do tend to increase their effectiveness. One good guide is to keep in mind that every visual should present one clear, concise idea.

The information presented by a slide is limited by several factors. The physical size and shape of a slide is a key limitation. The common 2 by 2 slide is two inches square but this includes the cardboard or plastic mount. The size of the image is 24mm by 36mm. This means that the image projected has a 2- by 3-inch aspect ratio; i.e., for every 2 inches in one direction there are 3 inches in the other. In TV, movies, or filmstrip the aspect ratio is 3 by 4, which really is not markedly different. However, all TV, movies, and filmstrip are horizontal; i.e., longer than they are high. For simplicity here, we will assume that the slide will be projected as a horizontal. There are many practical reasons for using only horizontal images. Some

images are a little awkward to make as horizontals, but this format should be used when at all possible. One of the paradoxes of our culture is that TV and movies both present only horizontal images, yet books present verticals as a rule. The transition is sometimes difficult.

The major task is to make the information readable. All too often there is a tendency to put too much information on a slide. There are also many times when the information is not arranged in a functional way. For example, a slide with only one long line of type on it may have letters too small to read even though it has only a few words on it. The same is true of a long vertical list of words or numbers. The information to be presented on the slide should be arranged so that it fits the 2- by 3-inch "box" that is being used. Like any other package, the material has to be folded until it fits the box. If it doesn't fit, something has to be discarded or put in another box.

One rather simple way to accomplish this is to draw a box 2 inches high and 3 inches long on typing paper. The material has to fit within this box. As a rule, this would mean that about 6 lines of type could be used with each line having some 26 letters. This allows for borders and some double spacing. If the information cannot be put in this box, it should be broken down into more than one slide. These boxes hold about as much as the audience can read. Do not forget that the briefer is closer to the screen than the audience. It might be large enough for the briefer to read, but the back row of the audience is further away. In carrels where there is only one person reading the screen, that is still about as much as can be read at a time. If more information is displayed on the screen, the viewer will be so busy reading that there will not be time to listen. Generally the visual summarizes or emphasizes the narrative. Care must be exercised to make certain that the visuals do not compete for attention with the audio.

There are many mechanical ways of drawing these 2- by 3-inch boxes. One way is to literally draw the boxes on typing paper. However, it is difficult for the photographer to include all of the typing without also including the box, so this procedure is usually used for only the first one or two slides. If an ortho film such as Kodalith is to be used in the photography, the lines can be drawn or printed in a light blue. Ortho film does not record certain shades of blue, so the blue lines are automatically eliminated when the pages are photographed. Another variation is to draw a rectangle on a piece of paper and place typing paper on top of it and put both in the typewriter. If the lines are dark, the outline can be seen through the typing paper. A 2- by 3-inch hole can be cut in a sheet of paper and used as a check after typing. Also, a 2 by 3 box can be drawn on transparent film or one could be made using vugraph material. Initially, though, more determination than mechanics is needed to keep within the limits. After getting used to the limits, it is easy and the legibility of the visuals is rewarding.

This description of using a 2- by 3-inch box assumes that a 12 point or elite type is being used. If the type is larger or smaller than this, appropriate adjustments in the size of the copy must be made. If the typewriter has proportional spacing there will be more than the 26 letters on a line, but the overall length of the line should be such that it fits within the 2- by 3-inch box with adequate margins. Naturally, if headliner or presstype lettering is used, the copy would be considerably larger than 2 by 3 inches.

However, the general considerations of format and number of lines, etc., remain the same. It is the legibility of the final projected image that we are concerned with. The 2- by 3-inch box is just a mechanical contrivance to aid in producing readable images. If a good 12 point or elite type is used, limiting the message to the format of a 2 by 3 box on the typing paper can produce an acceptable legible slide. Attempting to put more content than that on a slide results in print that is too small to be read comfortably.

## III. PREPARATION OF COPY

There are many ways of preparing copy for slides. As suggested in Section II, one very efficient method is to type the copy. When this is done, considerable care must be taken in selecting a typewriter. Figures 1 through 7 present samples from different styles of type and different models of typewriters. (These samples are enlarged so that the lettering is approximately the same size as it would be on the screen in a carrel.) It will be noted that the legibility differs markedly from sample to sample. Since these images were photographed and printed as a set, they are probably more similar than they would be if they were photographed at different places and at different times.

# OJT COST MILESTONES

Initiation
Literature Review
Cost-Factor Identification
Cost-Factor Quantification
Test/Validation
Final Report

*Figure 1.* UN-11-MC typing ball, Composer typewriter.

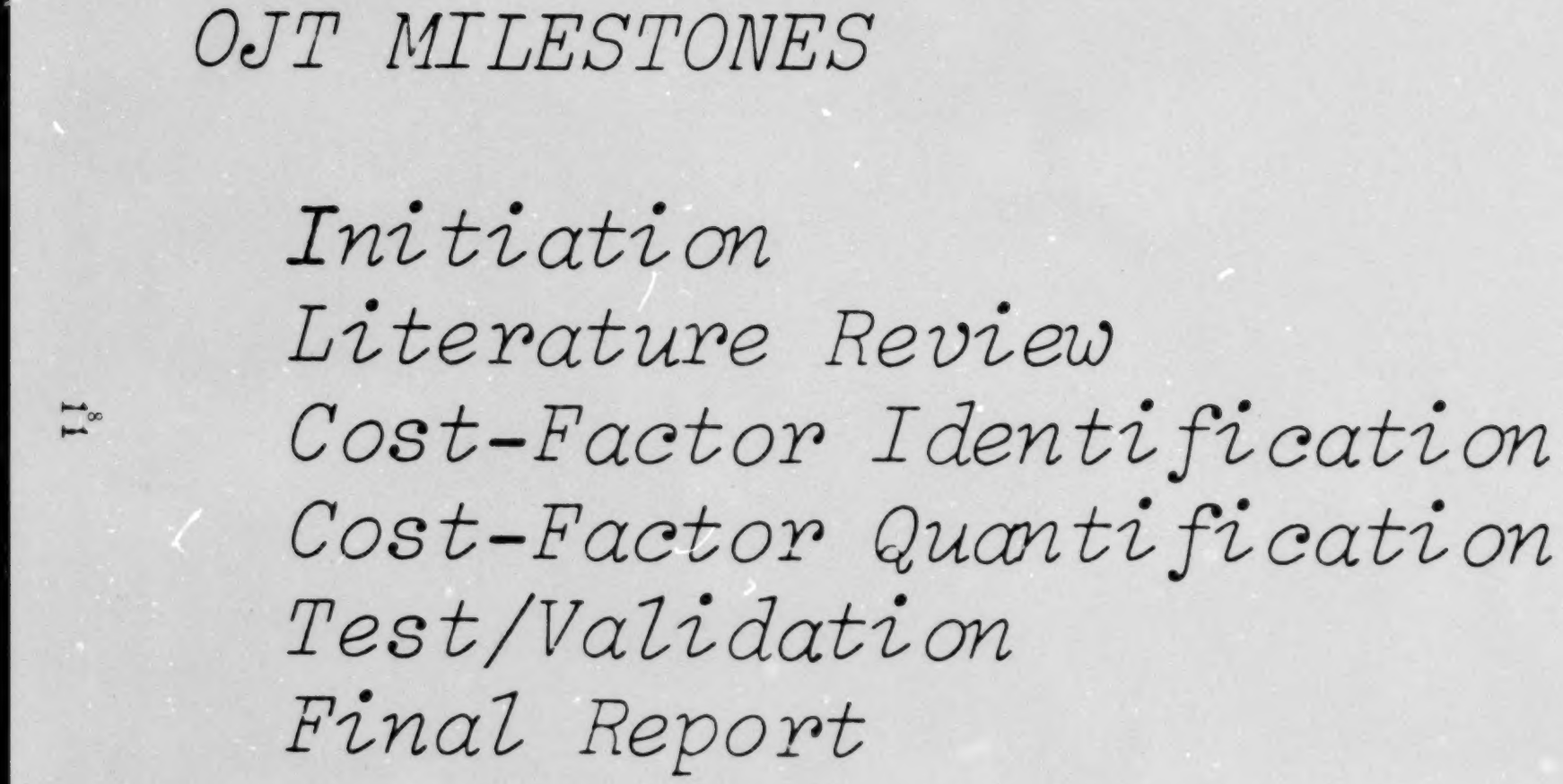



*Figure 2.* **Light italic (12) typing ball, Selectric typewriter.**

# OJT MILESTONES

Initiation
Literature Review
Cost-Factor Identification
Cost-Factor Quantification
Test/Validation
Final Report



*Figure 3.* Delegate (10) typing ball, MTST typewriter.

# OJT COST MILESTONES

Initiation
Literature Review
Cost-Factor Identification
Cost-Factor Quantification
Test/Validation
Final Report

*Figure 4.* Gothic (12) typing ball, Selectric typewriter.

# OJT COST MILESTONES

Initiation
Literature Review
Cost-Factor Identification
Cost-Factor Quantification
Test/Validation
Final Report



*Figure 5.* IBM Executive – PSM.

Two specific points merit emphasis. First, some type is more "forgiving" than others. Those types having even, bold characters will be legible even if the photography is slightly off. Those types with narrow lines will probably disintegrate noticeably if the exposure or focus is off even slightly. Second, it is a mistake to assume that large type provides better photographic copy than small type. It is the evenness of the letters that is important, not the original size. The size of the letters on the screen is determined more by the position of the camera than it is by the size of the letters being photographed. Bringing the camera close to the copy makes the letters on the screen large. If the original type is good and clean, the type can be enlarged many times and still be very readable. Large type is seldom clean, solid, and well spaced. This is caused by the mechanics of typing. A letter is created by striking a key against the paper that is supported by the platen. Since the platen is a cylinder, if the key is very large, the top and bottom edges do not strike the paper as firmly as the center portion. Big bold type is very legible and makes good vugraphs, but enlarging it photographically emphasizes the unevenness. Figure 6 presents one sample of this type. Even though not enlarged as many times as the other samples, it still suffers by comparison.

One important characteristic of narrative slides is the form of the individual letters. On all of the Figures 1 through 6, the edges of the letters tend to be rather rough and uneven. On Figure 7 the individual letters are more regular. The copy for this figure was made on a Headliner. It does produce much better copy. However, a trade off must be made between this additional quality and the cost involved. Conventional typing is cheaper and faster. Since it is fast and easy, changes in the copy can be made even if it results in retyping the entire slide. As a result, the content can be kept current and precise. It is not a matter of trying to use something that is cheap and looks cheap. It is a matter of using a technique that is appropriate to produce visuals that facilitate learning. If the increased sharpness of the lettering increases the cost without producing a commensurate increase in learning, it probably should not be required.

Figure 8 presents the same message typed in two styles. Normally, the message is more readable if the lower case letters are included. While using all capital letters is common on briefing slides, the style is not recommended for instructional slides.

On charts and graphs and on captioned photos, larger type is usually required since the original art is large. Most of this can be done with such techniques as Headliners, LeRoy lettering sets, or Compositors. For the less experienced, there are several varieties of press types that produce quality lettering. Such devices, as the Reynolds/Leteron, are very convenient and require little graphic training.

One point that needs to be re-emphasized is that typewriting can be used to generate good legible slides. However, it is essential that care be used in selecting the typewriter initially, that this typewriter be used consistently, and that it be kept in good repair.

## IV. ORTHO AND HIGH CONTRAST COPY NEGATIVES

When the typed or drawn message has been confirmed for accuracy by the requestor, the next step is to photograph the copy. The simplest form of photography for local production is to use a black-and-white film and make a negative. These negatives can then be mounted as slides or used in producing diazo or dual exposure slides. The generation of diazo and dual exposure slides will be covered in the next two sections.

There are many types of black and white film but the two most common for this type of work are (1) the graphic orthochromatic films, and (2) microfilm or high contrast copy films. These differ from the more common panatomic or Plus-X films in that they are designed primarily to produce blacks and whites rather than the gray tones in between; i.e., they are for line drawings rather than continuous tones. While panatomic film is designed to record all of the subtle grays in portraits or scenic shots, the graphic and recording films are developed to separate the blacks from the whites. When typed copy is properly recorded on ortho film, the lettering is virtually clear while the background is almost an opaque black. The gray tones in between, which can include erasures and smudges, are eliminated in the photographic process. For graphic work this is very desirable. Since the graphic film is usually ortho film, it is not sensitive to blue light. As a result, certain shades of blue can be used to print forms, guide lines, or to make corrections. When photographed, the blue is not recorded, leaving only the typed copy without the form or guide lines.

Two particular types of film will be covered here. The first type of film will be represented by High Contrast Copy (HCC), the second by Kodalith Ortho type 3. High Contrast Copy is microfilm sold in 36

# OJT COST MILESTONES

INITIATION

LITERATURE REVIEW

COST-FACTOR IDENTIFICATION

COST-FACTOR QUANTIFICATION

TEST/VALIDATION

FINAL REPORT

*Figure 6.* Orator (10) typing ball, Selectric typewriter.

# OJT MILESTONES

- Initiation
- Literature Review
- Cost-Factor Identification
- Cost-Factor Quantification
- Test Validation
- Final Report

*Figure 7.* Varityper – Headliner, typemaster V3677.

## CRITICAL AREAS

- Improving Reading Materials
- Improving Reading Skills of Personnel

## CRITICAL AREAS

- IMPROVING READING MATERIALS
- IMPROVING READING SKILLS OF PERSONNEL

*Figure 8.* Same message with and without lower case letters.

exposure magazines. Magazine is the term used by Eastman for 35mm film that is in a metal container usually called a roll, cartridge, or cassette. Technically each term has a slightly different meaning. More specifically, 36 exposures of High Contrast Copy film is HC 135–36. The letters designate the type of film (High Contrast), the 135 is the size (35mm) and, 36 is the number of exposures assuming standard double frame 24 by 36mm frames.

The ortho films do not come in 36 exposure lengths. A typical size is a 100-foot roll. More specifically, rolls of 35mm x 100-feet of Kodalith Ortho film 6556, Type 3, Sp. 653, perforated both edges on a No. 10 Spool. It is on GSA. At the time of this writing it was on GS-005-31672, Cat. No 168 6419, Price $6.32 per 100-foot roll. It is probably listed in graphic art catalogues. Since it is available only in bulk rolls, if it is to be used in a conventional 35mm camera body, a daylight loader and some empty magazines must also be obtained.

Loading magazines is relatively easy and can be done in regular room light. However, it helps to keep the loaded magazines in light tight cans to avoid possible light leaks (i.e., empty cans that come with regular 35mm film). Self-loading cans are fairly light tight, but if they sit in the light for several days before they are used there may be some leakage.

Ortho slides are particularly effective projecting on a front projection screen in a semi-lit room. They can be used under conditions not unlike a vugraph since the contrast is so great. They can also be colored with watercolors or felt tip markers to project colored images. Since the black background is so dense, there is no need to worry about keeping the color within the letters. Letting it run outside of them will not show on the screen. If all lines are to be the same color, the whole frame can be dipped into coloring or coloring washed over it. Since the film is on an acetate base, it dries very rapidly and has a very tough surface. It is one of the toughest films on the market.

This film really has too much contrast for use without coloring it in some way, except in a situation where the room is not darkened. If an attempt is made to use it like a normal colored slide, it will scintillate noticeably. The letters are so bright in comparison with the background, they appear to swim and are too bright to look at.

High Copy Contrast film is similar to ortho but not as extreme. When projected these are black and white but since about 1% of the light gets through the background, the screen is a dark gray rather than a jet black. Used to supplement colored slides, they are probably better than the ortho ones. Coloring is somewhat more difficult, since uneveness will show on the screen. They can also be used in making diazo and dual exposure slides but we do not find them as effective as ortho images. Since the background of the ortho is so completely opaque, lettering can be burnt in without background build up. Overexposure by a factor of 1,000 can occur and still only have the unwanted build up that HCC gives in one exposure. HCC is probably 10 to 1 better than Plus X in this respect.

Probably the biggest advantage of ortho or HCC is that it can be used without darkroom equipment and can be processed rapidly. We have routinely processed it in washroom sinks and had the slides on the screen one hour after they were shot. Again, their biggest use is as a negative for making diazo or dual exposure slides.

**Processing Notes**

Ortho film is exposed assuming an ASA of 6, but an exposure test with bracketing is recommended to determine the proper exposure for your equipment. With the small 2- by 3-inch field being photographed, bellows factor comes into play and shadows and reflections can be problems. However, the film processes in 5 minutes so running a test roll is not that much trouble. Also needed are Kodalith developers which come in two parts. These are mixed together just before processing. Standard hypo is used.

One of the advantages of this type of film is that the development is not nearly as critical as with color films. The temperature can vary so much that using room temperature is adequate. Also, the time can vary several seconds without making too much difference. The end result is remarkable. If a densitometer is used, the base fog of the clear areas should be 0.05 or below with the blacks 5.00 or above. The black is just about opaque. In fact, when they are projected it is not noticeable on the screen where the cardboard mount ends and the film starts. 5.00 would mean that it transmits one one-thousandth of one percent of the light that strikes it.

High Contrast Copy film has an ASA of 64. When it is developed in D-19 or similar contrast developer, it will have a base fog of about 0.20 and a maximum black of about 2.00. When projected, it is light gray on a dark gray rather than white on black. As with ortho film, the development of the film can vary considerably both in temperature and time. Crude processing in a rest room can be used when the precision of a darkroom is not available.

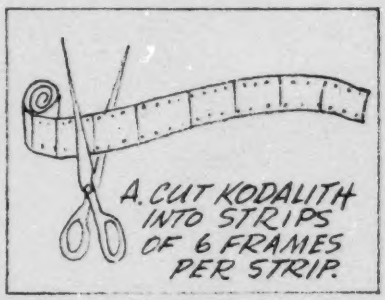
## V. DIAZO SLIDES

As suggested in the preceding section, one of the most common uses of ortho or high contrast copy negatives is for the production of diazo slides. While this process has been used for many years, as a techique for making 35mm slides it is still rather uncommon. For use in carrel instruction particularly, it is a very effective and economical method. One of the advantages of these slides is that they are attractive but not gaudy. At times a visual has to gain attention in somewhat the same way that an ad or poster does. These tend to be rather gaudy with an abundance of strong bright colors. However, within sequences where step-by-step instructions are being given, these attention getting splashes of color become distracting rather than beneficial. Since the gaudy slides tend to be expensive in terms of time and money, there are many benefits to be gained for reducing their use.

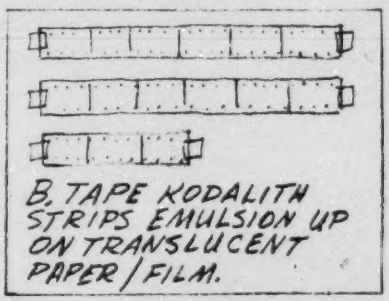
One rather acceptable production style that has proven to be both effective and economical is to reserve the colorful graphic slides for use as titles and where heavy emphasis is required. Between these, the instructional content is conveyed with typed diazo slides, dual exposure slides, or captioned photos. Since the diazo slides are probably the simplest to make, they will be discussed first.

Making diazo slides requires a good clean negative such as high contrast copy or ortho film. Since ortho film has more contrast, it tends to be somewhat easier to use. For brevity, we will assume that Kodalith Type 3 is being used. This will let us give specific instructions rather than general ones. In actuality, however, there are equivalent films that are equally suitable.

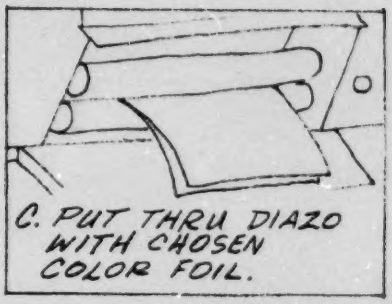
As shown in step A, the first step is to take the developed negative and cut it into strips. Each strip contains 6 images and is about 9 inches long.



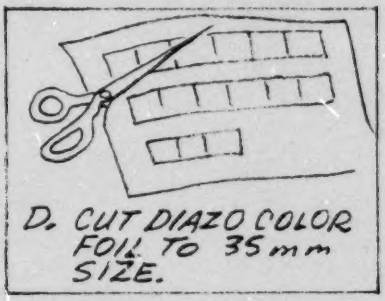

In step B, these 9-inch strips are taped to the type of translucent paper used for making 8- by 10-inch diazo transparencies for vugraphs. Tape with emulsion side up; i.e., away from the paper. In the example, we have only 15 images.



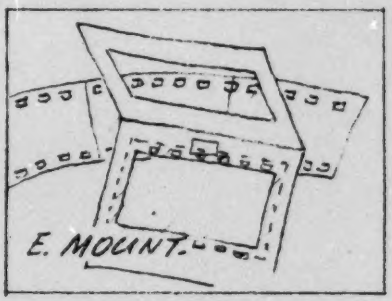
Step C, the diazo foil is made from these strips. With the extreme contrast that ortho film has, the letters on the diazo can be held clear while the background is made a saturated color.




In step D, the individual images are cut out with scissors. A good paper cutter can also be used. In either case, it is strictly a manual process.




In step E, these images are mounted in standard 2 by 2 slide mounts. There is one minor difference. The 35mm slides usually mounted in this way have a slight curl to them. This curl provides enough friction to hold the film in place while they are being inserted into the mounter. This diazo film is so flat that it does not stay in place. A small piece of tape can hold it in place long enough to get it into the mounter. The gummed labels, used on file folders, work well if cut into very small strips.




**Production Details**

While any diazo foil could be used, we find that there are one or two that seem to consistently produce more acceptable results than the others. The most consistent one is blue image with a clear base. This produces a dark blue background with clear letters. The "negative" type of slide with clear letters on a dark background is generally more suitable for use in a carrel than those with dark letters on a clear background. The foil called KMax produces a slide that appears dark brown to the unaided eye but projects as an attractive dark red. Unfortunately, we find that our results with it are often inconsistent. Other colors such as yellow and green are possible but do not have enough contrast. They are very light and difficult to read. The blue produces densities of 1.60 and above with base fog of 0.06. Any maximum density below 1.40 will probably be too light for consistent use.

We normally braket the exposure on the last image and also include a test chart that has a white area, a black area, and a resolution chart. These provide a constant check. Often such a simple thing as a lamp getting old, a change in typing paper, or a new brand of typewriter ribbon can make a change. The bracketing and test chart help to detect these variations and adjust them before they cause trouble.

The film actually used in the sample described had a maximum density of 5.52, base fog of 0.03, and the 18% gray card resulted in a density of 0.55. This last reading is used to verify exposure and shifts markedly since this film has exceedingly high gamma characteristics. This film is rather slow, having an ASA of 6 in our situation. This requires a six second exposure at f5.6 on our copy camera. Reducing this exposure from 6 seconds to 4 seconds decreases the desity of the 18% gray from 0.55 to 0.08. Extending the exposure from 6 seconds to 8 increases it from 0.55 to 2.61. It will be noted that these are less than 1/2f stop changes. However, the whites and blacks are stable through a very extended range. The very precise exposure control coupled with good latitude makes it possible to produce consistent negatives.

One production technique that might be used when shooting less than a full roll is to leave every 7th image unexposed. This makes cutting them into strips much easier. On all rolls, a little technique that saves a lot of time in cutting is to draw a narrow line down the edge of the 35mm negative. When this line is duplicated on the diazo it serves as a cutting guide for mounting. Without such a guide it is difficult to cut the diazo foil into the proper sized pieces for mounting. The divisions between the images are obvious, the top and bottom edges are not.

## VI. DUAL EXPOSURE SLIDES

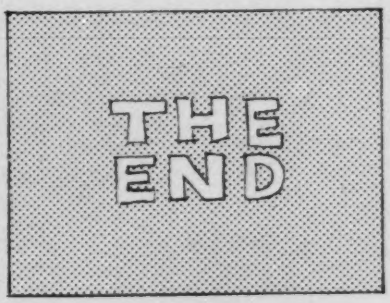
While there are many methods of generating dual exposure slides, they all have one feature in common, i.e., more than one exposure is made on each frame of film. This requires a camera in which either the exposure can be made without advancing the film or in which the film can be rewound accurately and then re-exposed. When rewound and re-exposed, one image must be directly on top of the other. While this does not have to be as accurate as the pin registration required for animation, it does require registration within 1/64th of an inch. This requires a fairly good copy camera.

Normally the message (words, formula, line drawing, etc.) is first photographed on ortho film as described in Section IV. This is then copied on color reversal film such as Ektachrome. If processed at this stage, the result would be a white message on a black background. The black background would not be as dense as that on the ortho negative, but it would be as dense as possible on color film. This black background is colored by making a second exposure on the same frame. Since the letters are already exposed completely, the second exposure has no effect on them. When developed, the result is a white message on a colored background. Normal color processing is used.

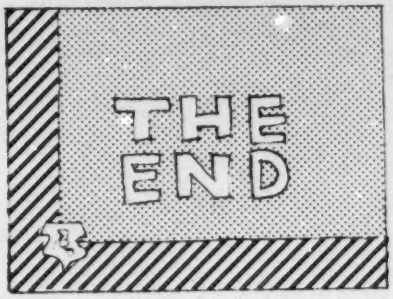
One very simple example would be to copy the ortho negative using a Repronar. If the Repronar with the built-in camera body is used, the film can be multiple exposed without advancing it. If a second slide is copied before the film is advanced, the result will be a duplicate of the second slide with the message from the ortho slide written across it in white.

For example; if the ortho slide has "THE END" and the second slide is a photo of a blue velvet cloth, the final slide will look like the words "THE END" were lettered on the velvet cloth. If the slide of the cloth were deliberately underexposed, the result would be white lettering on a dark, yet rich, blue background, somewhat the same effect as when white letters are placed directly on dark cloth, but much faster if several slides are required.

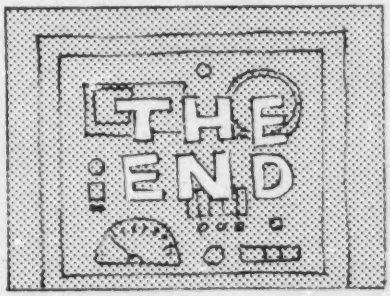
There are at least four main types of dual slides. Each technique produces slides that are distinctive. The first is to use plain colors for the background. These could be dark gels or slides made of colored paper. It would be relatively easy to build up a file of backgrounds by making slides of textured paper or fabrics of distinctive color or weave.



A second type of background would be a design or logo placed on a dark colored background and then repeated behind a full series of slides. A distinctive border might be placed down the left hand side and/or bottom with a small design in the corner. The message should be placed carefully to match the design. With a little care, a very polished series of slides can be produced in this manner.




A third technique is to use line drawings that represent the theme of the slide. For example, a line drawing of a simulator was drawn on blue paper. This was then used behind the full series of slides detailing the simulation project. The first slide was exposed normally and used to portray the simulator. In the following slides the background was underexposed to keep it from interferring with the message yet it retained the theme.




A very similar technique to this would be to use a pictorial slide that is typical of the project and use it as a background. Considerable care must be exercised in selecting the slide to make certain that it does not intrude into the message. Generally you want a rather plain photograph with no distinctive features and no white areas. When used as a background, it should be underexposed about two stops. This underexposure can be either on the original or created during the copying.

On all of the types, it is essential that the background be used to enhance the message. Great care must be taken to keep the background and the message from conflicting. For example, a light stripe through the center of the background will make the message very difficult to read. The concept of signal-to-noise ratio should be used in selecting any background. Make certain that the background adds to the information conveyed or to the ease of presentation. If it interferes with or detracts from the message it is doing harm rather than good. Normally, they must be simple and dark.

One major advantage of dual slides is that the backgrounds can be coordinated throughout the full series of slides. When working with lettering on colored backgrounds it is often unexpectedly difficult to find the desired color of paper in the quantity required.

When dual exposure slides are to be made with a duplicating camera such as the Repronar, it is necessary to convert all of the messages and backgrounds into slides so that they can be duplicated. On copy cameras such as the Forox or Sickles, the film can be rewound and exposed again. This allows for making all the exposures of the full series of messages first and then adding the backgrounds. They also enable the operator to work with larger negatives when desired and to use original art for backgrounds rather than requiring slides. This larger size facilitates very accurate placement of the images. The message should still be converted to an ortho negative; i.e., only the background can be photographed with reflected light.

While these are normally referred to as dual exposure slides, there is no reason to restrict them to two exposures. At times it is more convenient to number a presentation by photographing the number sequence as a third series of exposures. At other times the background might be created by building up more than one image.

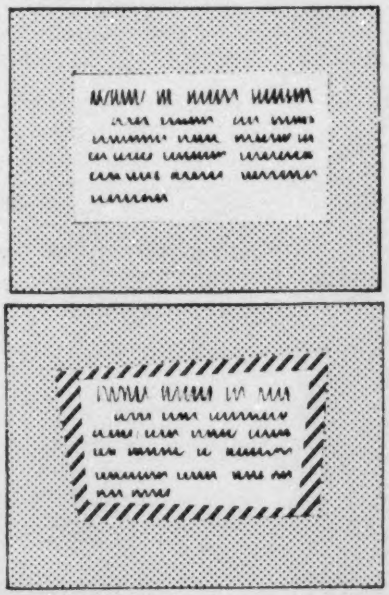
While these techniques are generally used in narrative slides, they are particularly effective with line drawings. A simple line drawing can be made very impressive by converting it to white lines on a colored background. A point to keep in mind is that white lines on color are much easier on the eyes than fine black lines on a glaring white background.

## VII. POSITIVE SLIDES

The slides discussed to this point have been negative slides: i.e., the lettering or typing is presented on the screen as white letters on a dark background rather than black letters on a white background. In this section we will be discussing slides made by photographing typed copy with color reversal film giving black words on a light background. While this is probably the simplest of all techniques discussed, it is also the one that is most often overlooked, or if used, used poorly.

If the original typing as described in Section III is photographed as it is, the black lettering will be very legible but the slide will probably not be very appealing. The white background is so bright in comparison to most visual that it hurts the eyes. The overall slide tends to lack interest.

One very effective technique that adds a considerable amount of impact with very little additional effort or money is to simply cut the typing out and lay it on a colored background while photographing it. Minor variations would be to cut out the lettering and paste it on colored paper, then cut this out and lay it on a second, coordinated color. That way you have the letters on white background with a narrow frame of one color accentuated by the second color. The cutting should be done with a paper cutter to obtain the straight edges. Deliberately avoiding square corners, resulting in areas that are not rectangular, can often be used to add interest. They are also easier for an unskilled person to make. Using this technique, titles or data from publications can be cut out and used. Care must be taken to avoid including too much text in such cases.



An alternative to this is to lay the typed copy under the copy camera and then surround the message with sheets of colored paper or cloth. Since they are merely laid on the typed page, the same paper or cloth can be used repeatedly. The fabric department of many department stores often sell small pieces of felt in many colors. The pieces are about the same size as a sheet of typing paper. These have enough thickness and texture to photograph well. They can add a great deal to a slide.

It is also rather easy to cut out a mask from colored paper and lay it on the typed paper surrounding the message. Again, if two colors are combined, a rather interesting effect can be obtained. Since the cut-out frame is reused, it is possible to put a small logo in the corner to identify the presentation or organization.

It is also possible to put gels over the paper or filters over the camera lens to add color to the white paper. While it is possible to type on colored paper, we find that it seldom turns out as well as was expected. However, an exceptionally good technique that we recently saw on some commerical courseware was typed with a white ribbon on clay coated colored paper. The results were most impressive.

The copy for this type of slide should be prepared using the guides proposed in Sections II and III. If excessive material is photographed the slide will not be legible. Technically, a 35mm slide is merely a form of microfilm and full pages of material can be copied on it. A good quality projection lens will put all of this on the screen. However, the viewer cannot read it. In borderline cases where the message is minimally legible, he can read it but cannot attend to the speaker. In such cases, he can either read or listen but cannot do both at the same time. If the slide cannot be read easily with the unaided eye, the audience will have trouble reading it when it is projected.

In photographing positive slides, it is generally wise to underexpose them one or two stops from the incident light reading. The pure white background behind the typing tends to overpower the rest of the slide. Full exposure will often reduce the legibility of some of the type. Some experimentation is required to get the final exposure, but in general, errors should be made on the side of underexposure rather than overexposure. However, do not forget to compensate for bellows extension.

One very effective technique especially suitable to these positive slides is the use of colored bullets to denote specific parts of the slide. For example, when discussing a program that has five steps, a red marker pointing to the particular step being discussed will aid the audience in following the presentation. The cameraman can move the red marker down one step at a time so that the final set of slides has a slide emphasizing each of the successive steps. This results in more slides but one of the advantages of slides is that the image can be advanced so easily that many can be used. In comparison to such techniques as vugraphs, slides are so small and easy to change that several can be used to cover the information originally on a single 8 by 10 vugraph. If several slides aid in directing the attention of the audience to the precise point being discussed, then they are worthwhile.

## VIII. CAPTIONED PHOTOS

A survey of learning centers conducted by Sullivan[1] et al., for the USAF indicated that while courseware production was a major problem with most centers, few had developed specific techniques for such tasks as the initial preparation of visuals and the later updating or revisions of the visuals. In general, the adoption of a learning center creates a demand for visuals that greatly exceeds the normal production levels.

One style of preparation that holds promise is to place captions on photos. Rather than drawing an image, labeling the parts, and writing a title under it, substitute a photograph for the drawing but still label the parts and place a title on it. The slide is then made by copying the "card art"; i.e., card with the photo, labels, and titles glued to it.

This method requires that all images be prepared on uniform 8 by 10 size card stock. It relies heavily on photography and makes a concerted effort to use 35mm single lens reflex cameras to generate as many of the images as possible. For example, in a step-by-step procedure, each step is photographed using a 35mm camera with interchangeable lenses. These negatives are enlarged to color or black and white prints. These prints are permanently bonded to a fairly heavy colored card stock. By adding a few words in a caption and an arrow or circle to highlight essential actions or parts, images may be created that combine the economy of the photograph with the clarity of the graphic. Usually, about 60% of the images in an instructional sequence can be prepared in this way.

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[1] **Sullivan, Dennis J., Smith, Edgar A., and Filinger, Ronald H.** *A survey of the present state-of-the-art in learning center operations.* AFHRL-TR-74-11, AD-776 776. Lowry AFB, Colo.: Technical Training Division, Air Force Human Resources Laboratory, February 1974.

With these captioned photos on hand, it is very easy to use them as a detailed story board during tryout and revision. They must be handled with care, touching only the outside edge where a one inch border has been left for this purpose. The images that must be revised can be changed individually. Images can be inserted or deleted at will. Minor changes within the captioning can be done. While it is usually desirable to have the images numbered, the numbers can be inserted by laying numbered tabs on the art during the final photography. Such number or other identification should be distinctive and in the same location on all frames within a series to avoid confusion with subject matter material. It is suggested that the very bottom half inch be used for production notes. This is outside the area photographed. Any unusual instructions the photographer needs can be placed on the right. A code number identifying the course, block, and frame should be on the left.

These procedures may be clarified by referring to Figures 9, 10, 11, and 12. They represent typical captioned photos matted on 8- by 10-inch card stock. It should be noted that it is the card stock on which the photo is mounted that is a standard size. The photo itself may be 8 by 10 inches or smaller with 4- by 5-inch and 5- by 7-inch sizes being common. With the smaller size photos, the captions are generally placed adjacent to the photo rather than on it. The captions are very effective in developing step-by-step procedures. Highlighting or calling attention to details can readily be done by adding words, arrows, or circles to the print. Black and white photos on colored card stock and with colored arrows or circles are particularly effective since color is reserved for directing attention to the essentials. If a 4- by 5-inch polaroid back for a view camera is available, these polaroid prints can often be used, especially during revisions.

In the final photography, the first image is placed under the copy camera and carefully positioned in a holder. The area photographed is 5¼ by 8 inches to correspond to the 2- by 3-inch aspect ratio of a slide (24 by 36mm). Additional bleed area is allowed at the top and bottom so that an area 6 by 8 inches can be photographed for filmstrip, video, or movies. Filmstrip has a 3 by 4 aspect ratio (18 by 24mm). This still allows an additional inch on all sides to provide for handling, bleed for video, and margin notes.

After the camera setup is complete and the holder affixed to the table, all subsequent images are made without requiring further camera adjustment. In this way, productions can be re-shot in minimum time. Leaving the additional bleed area at the top and bottom of the area photographed for a slide allows the slide art to be used for movies, TV, or more often to generate a filmstrip. If only a few copies are needed, multiple copies of the filmstrip can be generated. If many copies are required it would be more economical to make a master and have duplicates made on a loop printer.

The essential feature of the captioned photo technique is that all images be uniformly placed on standard size mats. There may be some variation between lessons or packages, but within each uniformity is essential. The actual size is rather arbitrary. The 8- by 10-inch was selected since it is large enough so that much graphic work can be done on it yet it is small enough so that 35mm photographic negatives can be used rather than requiring a larger size. If the art board is purchased in standard 30- by 40-inch sheets, it may be desired to cut these into 7½- by 10-inch pieces to save waste. But again, within a lesson, all images are uniform.

The captioned photo technique has many additional advantages that become apparent as the program grows. The first is that it encourages the use of photographic techniques in coordination with graphic production. The camera (especially the 35mm SLR with built-in exposure meter and interchangeable lenses) and the enlarger are amazingly creative tools when systematically employed. If the enlarger and camera are accepted as graphic tools, and photography and graphics combined rather than being separated by outmoded procedures and regulations, much time and money can be saved.

A second advantage is that the final visuals can be duplicated with unexpected ease and quality. Duplicate slides can be generated from the original card art without the increased contrast resulting from slide duplication. Filmstrips can be updated by the change of individual images and re-photographed in a matter of minutes. The difficulty of updating filmstrip has been seriously *overestimated*. Successful duplication, however, does require standarized copy. Similarly, the difficulty of generating acceptable duplicate slide sequences from slides has been seriously *underestimated*. In large volume, the man hours required to mount the slides and get them properly arranged in trays soon becomes overwhelming. The deterioration in quality is great.

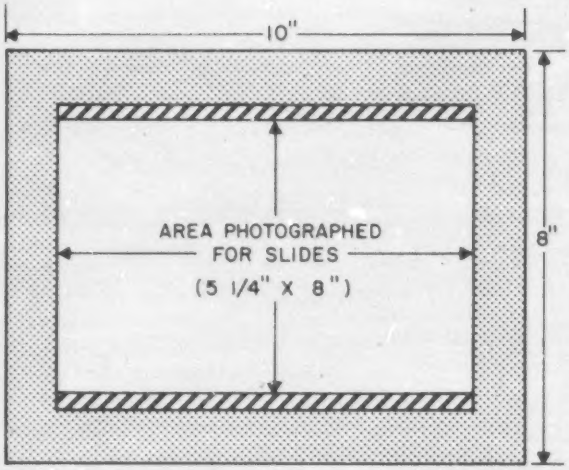


*Figure 9.* Basic format of 8- by 10-inch card. Cross hatched area is bleed area for filmstrip.

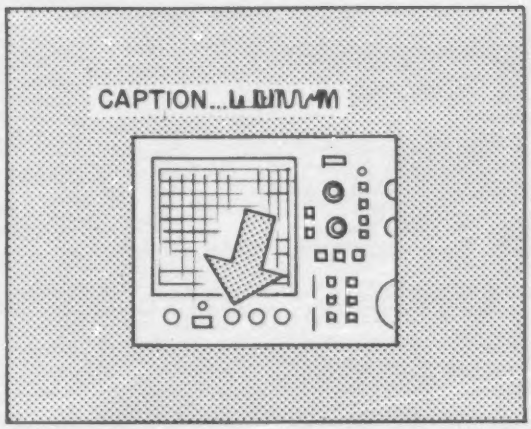


*Figure 10.* Caption and colored arrow added to 4- by 5-inch black and white photo.

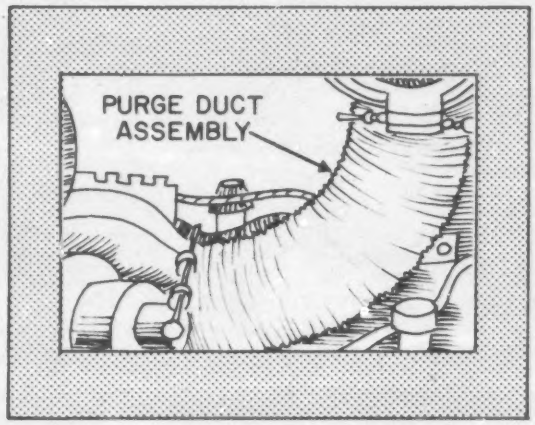


*Figure 11.* Lettering placed on 8- by 10-inch photo cropped to 6- by 8-inch or mounted full size.

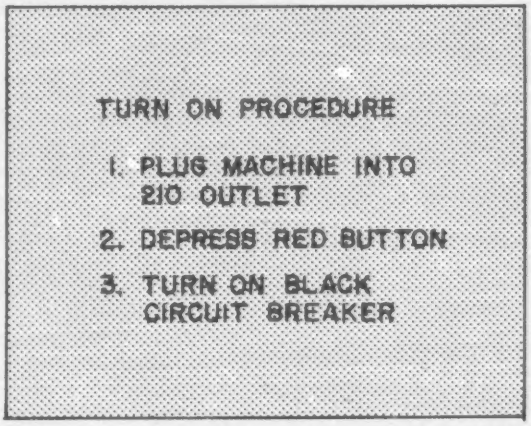


*Figure 12.* Lettering or photographically enlarged typed copy.

A third advantage is that minor revisions can be made in the total sequence without a major redo. The developer can look at the finished card art and do some final polishing without introducing major costs or delays. Being able to survey the total sequence as a story board is very helpful.

A fourth advantage in having every visual image developed in the form of standard size 8- by 10-inch card art is that it enables the development of the program in such a way that it can be produced as slides, 35mm filmstrip, 16mm filmstrip, or 8mm filmstrip with equal ease. The same images may serve as a final story board for movies or TV. In essence, the program can be developed first and the media selected later. Also changes from one medium to another at a later date can be made with minimal additional effort. Compensation can be made for the slight difference in shape between slides and filmstrip.

## IX. SUMMARY

The current emphasis on self-paced individualized instruction within USAF is often accompanied by a massive increase in the number of slides required. Whether used in prenarrated slide sequences or other forms of mediated instruction, visuals are being required in numbers that far exceed the production capabilities of many bases. This effort is an attempt to suggest production procedures and techniques that might facilitate the meeting of these requirements, without excessive expenditure of money and/or manpower.

The approach used was to obtain samples of existing material that was felt to be representative of current instructional packages. The first sample was of instructional slides. These were then sorted in many ways to attempt to develop a schema for categorizing them. This suggested that one practical method of categorizing visuals would be in terms of skills required to produce them rather than in terms of content or style. This resulted in a classification into (a) those drawn or lettered by a graphic artist, (b) those created by photographers, (c) those copied from existing material, and (d) those produced by typists. Following this, a large series of prenarrated slide and filmstrip presentations were reviewed and the image classified.

While the surveys indicated that the great majority of the instructional slides presently being used are produced from illustrations drawn by graphic artists, it was observed that about 60% of these slides could be generated photographically if the photographs had titles and arrows added to them. About 15% of the images could be obtained from existing publications and, thus would require little or no production time. Approximately 10% of the images could be typed. The remaining 15% would require line drawings or other forms of illustration that must be produced by graphic artists.

Two "cost" samples were studied. The first was a sample of graphic materials selected to represent the variety of graphic materials produced on a typical Air Training Command base. An estimate of production time was obtained from three skilled graphic artists estimating the time it would take to produce these visuals. Results were compared to production records and used as an estimate for the time it takes to produce instructional material. Additionally, estimates were obtained from ATC, commercial firms, and contractors on the cost to produce visuals and averaged over a long production period. While few firms have accounting procedures that isolate production costs, very consistent results were obtained which suggested that the costs probably can be estimated with considerable accuracy. Averaged over a large number of images, the typical graphic used in USAF instruction was estimated to require about three hours to produce. This is total time, including coordination, clean-up, etc. Reasonable cost estimates appear to be $23 to $24 if produced in-house and $30 to $40 if purchased. These figures are not to be construed as verified and documented absolutes, but as a guide in estimating total production costs.

If you have a requirement for five sequences, each of which contain 75 images, then you probably should assume that you will require some 1,000 man-hours to produce the basic artwork. It might well be anticipated that a production of this size will take more than a calendar year to complete; and on the average, from 20 to 35% of the programs will require content up-dating each year. All told, a production of this size is a formidable task in most situations.

In attempting to reduce this investment in labor, several alternate production techniques have been attempted. One technique was to duplicate existing slides. While this was often tried, the results were usually disappointing. Two production techniques were particularly encouraging. Both attempted to find

substitute methods of producing some of the graphic images in order to conserve the graphic artist's time for the production of essential graphics. The first technique was the simple expedient of using a typewriter to produce as much of the lettering as possible. The second was to use captioned photographs to replace line drawings whenever possible.

Successive sections in the report describe in some detail how these alternative techniques might be used. With reference to the use of typed material, considerable attention is paid to the format. Basically, if the material can be typed in a 2- by 3-inch rectangle, good images can be produced. This limits content to approximately 6 lines of copy with each line containing no more than 26 letters. Care in selecting and maintaining the typewriter is required. This typed copy can be converted into slides in many ways. Techniques found suitable include the use of graphic film such as Kodalith. This is particularly suitable if the slides must be projected in semi-lit rooms. These images can be converted into white letters on a dark blue background by diazo processing. Double exposure techniques can also be employed. The typed copy can also be mounted on colored construction paper and photographed with regular color film.

The captioning of photographs and the use of arrows and other methods of calling attention to specific portions of the photo appears to be one of the most efficient and effective techniques. When used to generate a set of 8- by 10-inch pieces of card-art, many advantages were obtained. These advantages included the ease of duplication without loss of quality, ease of making revisions, capability of converting from one medium to another, and finally, provides a detailed storyboard which in itself is a major contribution to effective writing.

**Conclusions**

It is urged that production techniques be developed that utilize all three specialties (typing, graphic, and photographic) rather than concentrating on a single type of image. This will result not only in variety in the training program, but will also foster economy and increased efficiency.

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